CRUISE REPORT

W-134

Scientific Activities Undertaken Aboard *SSV Westward*

Woods Hole - Lunenburg, Nova Scotia - Woods Hole

July 5 - August 1, 1994

Sea Education Association - Woods Hole, Massachusetts

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Preface

Leaving Dyer's Dock on the afternoon of July 5th, the crew and students on board the *Westward* were full of excitement and anticipation as to what the next 4 weeks might bring. Returning to that same dock on August 1st, all on board had shared in an adventure and forged friendships that would be cherished for years to come.

The first few days were spent learning the ropes (I mean "lines") and gaining our sea legs. Fog and the myriad of fishing vessels on and around Georges Bank made for a good introduction to the world of radar navigation. The bank was also fascinating from an oceanographic standpoint, with strong currents and waters thick with plankton. Our first scientific superstations were a great success and a learning experience for all (including, it seems, the shearwaters, who were always ducking their heads underwater to see what we were up to).

At the shelf break we began to see *Sargassum* in the water and as we sailed further east, we entered the warm, clear waters of a warm core eddy. Clear sunny days made for beautiful sailing and sampling weather. Deep hydrocasts and meter net tows sampled the unique structure and biota of the eddy, while neuston tows collected a variety of organisms associated with the *Sargassum* and an occasional unwelcome stinging guest. A mid-day swim call in the crystal clear waters was a welcome break from the rigors of shipboard life. Soon after the swim call, the surface waters started to turn chilly as we headed out of the eddy towards the Nova Scotian shelf. Sightings of whales and porpoises kept us entertained as did wonderfully creative creature features. As we sailed toward the Gully and our next sampling stations, the watches competed in a line chase and sail handling manuevers. After a transect across the submarine canyon known as the Gully, we headed for Sable Island with a stiff breeze. Although the day was wet and cold, the visibility was good and we were able to anchor and go ashore for several hours of hiking among the dunes and wild horses of Sable Island.

Our next stop was Lunenburg, Nova Scotia, where we spent 3 days exploring the town and countryside by foot and bicycle, sampling the local ice cream vendors, and visiting with the folks aboard the *Cramer*. Good food and fun were had at a *Cramer/Westward* barbeque, complete with games involving ship's lines and requiring great skill and dexterity among the contestants.

We encountered the roughest weather of the trip as we left Lunenburg. With several people looking a bit green, our visitor from the University of Maine toughed it out and gave a talk on the circulation of the Gulf of Maine. The winds settled down the next day as the fog again descended on our ship and the surface temperature dropped to a mere $6^{o}C$. A transect across the mouth of the Bay of Fundy completed the scientific sampling for the student projects. The next several days were crammed full of data analysis and interpretation in preparation for the project presentations. Breaks included a birthday celebration for everyone on board and a day in which the staff prepared a symphony of culinary delights ... and lots of it!

We cleared customs in Gloucester and after a photo shoot of our floating home, sailed through bioluminescent waters towards the Cape Cod Canal. Our last full day and night were spent in Tarpaulin Cove. The perfect end to a wonderful summer cruise, we enjoyed an extended swim call, a wild and wet schooner race, and a memorable sunset swizzle.

I would like to extend my personal thanks to Captain Terry Hayward for making my first cruise aboard the *Westward* a thoroughly enjoyable one. The success of the cruise was made possible through his leadership, strength of character, and humor. Ken Neal, Jim Millinger, and Jeremy Bumagin gave selflessly of their time in all conditions and at all hours. Jim also provided insightful lectures and led discussions as the maritime studies instructor on board. John Thomson not only kept the engines and electrical systems up and running, but entertained us with songs and stories. Laura Fitton, our steward extraordinare, did amazing things in the galley and kept everyone (especially the chief scientist) full and happy with homemade bread.

A great deal of science was accomplished on the cruise, thanks to our industrious assistant scientists. Leah Feinberg kept the lab running well even when our instruments were having difficulties. Her experience, knowledge, and patience were invaluable to the scientific program. Rich Blundell gave several interactive and creative lectures and was our resident geologist. Jeff Schell made his first trip with SEA a memorable one; the pig will never be the same. My thanks to all 3 assistant scientists for their enthusiasm and hard work.

The students of W-134 made the cruise a success and a wonderful adventure. Your willingness to participate, to learn, to scrub, to cook, to stand bow watch in heavy seas and thick fog, to encourage, and to laugh made our time at sea a pleasure. I hope you continue to seek out meaningful ventures in your life.

Tracy Baynes
Chief Scientist, W-134

Ship's Compliment

Nautical Staff:

Terry Hayward	Captain
Ken Neal	Chief Mate
Jim Millinger	Second Mate
Jeremy Bumagin	Third Mate
John Thomson	Engineer
Laura Fitton	Steward

Science Staff:

Tracy Baynes	Chief Scientist
Leah Feinberg	First Assistant Scientist
Rich Blundell	Second Assistant Scientist
Jeff Schell	Third Assistant Scientist

Maritime Studies Staff:

Jim Millinger	Maritime Studies Instructor

Students:

Heidi Anderson	Western Kentucky University
Lena Baldwin	Bates College
Staci Bula	Beloit College
Karen Engler	Middlebury College
Amy Flanders	Middlebury College
Paul Haraf	University of Miami
Patrick Jackson	College of Charleston
Stephanie Jones	University of North Carolina
Nanette Loiselle	Clark University
Jeff Michel	Yale University
Melissa Reilly	Georgetown University
David Rentz	Boston College
Sarah Ringold	Princeton University
Mike Sanctuary	University of Colorado
Jared Volpe	Dickinson College
Charlie Walton	Brown University

Visitor:

Robert Hetland	University of Maine

Academic Program:

Date	Topic	Lecturer
7/7/94	Sampling Techniques Demonstration	Leah Feinberg
7/8/94	The Atmosphere and Global Warming	Tracy Baynes
7/11/94	Geology of Georges Bank	Rich Blundell
7/12/94	Potential Effects of Oil Production on the Biota of Georges Bank	Tracy Baynes
7/13/94	Physical Processes in Estuaries	Jeff Schell
7/14/94	Larval Adaptations in Estuaries	Jeff Schell
7/15/94	Practical and Lecture Exam	
7/18/94	Submarine Canyons and Black Bears	Rich Blundell
7/19/94	Tides	Tracy Baynes
7/23/94	Circulation in the Gulf of Maine	Robert Hetland
7/25/94	Effects of Sedimentation on a Tropical Rock Reef Community	Tracy Baynes
7/26/94	Tracking Marine Wildlife	Rich Blundell
7/27/94	Sea Birds	Leah Feinberg
7/28/94	Project Presentations	
7/29/94	Project Presentations	

Research Program Summary

This report gives a summary of the oceanographic research conducted on cruise W-134. The *SSV Westward* sailed from Woods Hole on July 5, 1994 . Our cruise track took us across Georges Bank, over the shelf break and slope, through a warm core eddy, up to Sable Island, west across the Scotian Shelf to Lunenburg, Nova Scotia, around the southern tip of Nova Scotia, across the mouth of the Bay of Fundy, south through the Gulf of Maine, and finally, through Cape Cod Canal and back to Woods Hole on August 1, 1994 (Fig. 1). Our oceanographic research goals were to describe and compare 1) the physical, chemical, and biological aspects of the water column on Georges Bank, outside and within a Gulf Stream warm core eddy, and across the Bay of Fundy, and 2) the sedimentary regimes on Georges Bank, the Scotian Shelf, and across the Bay of Fundy. Everyone participated in the collection of the oceanographic data. Analysis and interpretation of the data were undertaken by three research groups. They were as follows: 1) physical and chemical aspects of the water column (Heidi Anderson, Lena Baldwin, Paul Haraf, Nanette Loiselle, Mike Sanctuary, and Charlie Walton), 2) water-column biology (Amy Flanders, Patrick Jackson, Stephanie Jones, Melissa Reilly, and Jared Volpe), and 3) sediments and benthos (Staci Bula, Karen Engler, Jeff Michel, David Rentz, and Sarah Ringold).

The physical and chemical properties measured included temperature, salinity, light attenuation, dissolved oxygen, phosphate, and chlorophyll *a*. Temperature and salinity with depth were measured with a Conductivity-Temperature-Depth Probe (CTD), while light attenuation was measured using a secchi disc. Water was obtained either at the surface with a bucket or at depth from hydrocast Niskin bottles. To sample the plankton and neuston, nets were towed at the surface (neuston net and phytoplankton net) and at depth (meter net). Samples of the bottom sediment and benthos were obtained with the use of a shipek grab.

The following is a summary of the results obtained by the students and their interpretations. The report is divided into the four regions studied, namely Georges Bank, a warm core eddy, the Scotian Shelf, and the Bay of Fundy.

GEORGES BANK

Physical-Chemical Studies:

Sampling was conducted at three stations (west of Georges Bank, central Georges Bank, and the eastern flank of Georges Bank) to determine how the physical-chemical properties differed off and on the bank, and over a shallow and deep region of the bank. A CTD and secchi disc deployment and hydrocast were conducted at each of the stations.

The station west of Georges Bank exhibited a stratified water column with a distinct thermocline, halocline, and pycnocline at a depth of 20 m (Fig. 2). The warm (18^{o}C) and less saline (31.6 ^{o}/oo) surface waters corresponded to the temperature and salinity range of Maine Surface Water (1-17^{o}C, 31.6-33.2 ^{o}/oo), while the cooler (5^{o}C) and more saline (32.9 ^{o}/oo) subsurface water (50-130 m) corresponded to the temperature and salinity range of Maine Intermediate Water (1-7^{o}C, 32-33 ^{o}/oo). The water column at the shallow Georges Bank station exhibited a uniform temperature and salinity of 13.6^{o}C and 32.4 ^{o}/oo respectively, revealing that the water over the shallow bank is well mixed (Fig. 2). Strong tidal currents are thought to be responsible for this mixing. Measurements of temperature and salinity with depth over the eastern flank of Georges Bank revealed a stratified water column with warm (17^{o}C), less saline (32.4 ^{o}/oo) water to a depth of 15 m, and cooler (9^{o}C), more saline (32.9 ^{o}/oo) water below 40 m (Fig. 2). The surface water exhibited the temperature and salinity characteristics of Shelf Water, while the subsurface water corresponded to that which has been termed the "cold band", consisting of Georges Bank Water, Maine Surface Water, Maine Intermediate Water, and Upper Slope Water.

Secchi disc measurements were used to determine the 1% light level. The stations west and east of the shallow bank exhibited relatively deep secchi disc depths (10.5 m and 10.6 m) as compared to that measured at the shallow bank station (6 m). The depth of the 1% light level at each station from west to east was estimated at 30 m, 17 m, and 31 m.

The profiles of dissolved oxygen and phosphate concentration with depth gave further evidence that the shallow bank was well mixed. The oxygen and phosphate profiles from the shallow bank station showed little variation with depth (Fig. 3). In contrast, the off bank and eastern flank stations exhibited a general trend of decreasing oxygen and increasing phosphate with depth (Fig. 3). This trend might be expected in less well-mixed waters due to the decomposition of organic matter and a reduction in the photosynthetic rate and/or phytoplankton density with depth.

The shallow bank chlorophyll profile exhibited relatively high surface and subsurface concentrations, indicating high primary production throughout the water column (Fig. 4). Four out of the five chlorophyll concentrations recorded on the shallow bank were between 4 and 7 ug/l, higher than any of the values obtained from the off bank and eastern flank stations. The off bank station exhibited a chlorophyll *a* peak at 30 m, just above the depth of the 1% light level and below the pycnocline (Fig. 4), while the eastern flank station exhibited a peak at 20 m, approximately 10 m above the 1% light level depth and within the pycnocline. The locations of these peaks suggest that phytoplankton are taking advantage of nutrient pulses from below while remaining at a depth where there is sufficient light for photosynthesis.

Water-Column Biology Studies:

The water-column biology group provided a qualitative description of the abundance of various phytoplankton species, a quantitative description of the density, diversity, and evenness of zooplankton, and an analysis of 4 potential indicator species. The analysis and interpretation of the indicator species data will be presented after the discussion of the 4 regions.

Georges Bank was dominated by diatoms of the genera *Chaetoceros* and *Coscinodiscus*. Their abundance was high, while the overall diversity of phytoplankton on the bank was low. Diatoms are indicative of high-nutrient environments and as such, provide further evidence that Georges Bank is a well-mixed and highly productive region.

Zooplankton density was high on Georges Bank, while diversity and evenness were intermediate between that obtained in a warm core eddy and the Bay of Fundy (Fig. 5). Neuston tows conducted during the day and night revealed an increased zooplankton density (Fig. 6) and abundance of crab larvae (57.3% vs. 0.5% of the sample) in the surface waters at night. This suggests that some zooplankton species and crab larvae are undergoing a vertical migration, remaining in the dim waters during the daytime and rising to the surface during the night to feed on phytoplankton. It is thought that this strategy affords the migrators protection from visual predators. On several occasions during the cruise, the Precision Depth Recorder (PDR) trace revealed a downward migration that occurred around 0500 to 0600 and an upward migration that occurred around 1900 to 2000.

Sediment and Benthos Studies:

One shipek grab was taken at each of the following 3 stations: 1) west of Georges Bank at a depth of 143 m, 2) on a shallow region of Georges Bank at a depth of 30 m, and 3) on the eastern flank of Georges Bank at a depth of 75 m. In order to determine the grain size distribution and sorting of the sediment at each location, samples were wet sieved into 8 grain size fractions: 1) > 3000 um, 2) 2000-3000 um, 3) 1000-2000 um, 4) 500-1000 um, 5) 250-500 um, 6) 125-250 um, 7) 62.5-125 um, and 8) < 62.5 um. The percent of the total volume within each grain size fraction was then measured.

The sample obtained west of the bank was poorly sorted, with 14% or more of the volume accounted for by each of the 5 grain-size fractions ≥ 250 um (Fig. 7). The 500-1000 um fraction exhibited the highest percent by volume (25%) and the < 62.5 um the least (1%). The sediments > 2000 um consisted mostly of quartz, with some shale, feldspar, and shell fragments. The grain size distribution and composition of this sample are consistent with that of a moderate energy environment near a terrigenous sediment source.

A majority of the sediment collected from the shallow Georges Bank station fell within the 250-500 um size fraction (67.5%), indicating a well sorted sample of sand (Fig. 7). The sediments > 2000 um consisted of gastropod, echinoderm, and bivalve fragments. The shipek grab at the eastern flank station collected a similarly well-sorted sample (Fig. 7). Sediments between the sizes of 500-1000 um dominated the sample (69.5%), with the larger grains (> 2000 um) consisting of quartz, shell fragments, and muscovite. Both of the bank samples are representative of a high energy environment. It is well documented that the currents over and around Georges Bank are strong. Currents and storm waves winnow away fine sediments and constantly rework the remaining sand, resulting in well-sorted and well-rounded grains.

The physical, chemical, biological, and geological data obtained from Georges Bank during cruise W-134 reveal the region to be one of high mixing and high productivity. It is no wonder that the bank has served as a major fishing ground for both Canada and the United States over the years.

WARM CORE EDDY

Physical-Chemical Studies:

Four stations were sampled in our transect across a warm core eddy. The first of these was outside and to the west of the eddy, the second was at the western edge of the eddy, the third was within the eddy, and the fourth was at the eastern edge of the eddy. A CTD and secchi disc were deployed at each station and a hydrocast conducted at all but the station inside the eddy.

The temperature and salinity profiles revealed a deepening surface layer of warm, saline water as we travelled into the eddy (Fig. 8). The depth of the 18^{o}C isotherm increased from 45 m at the outside station to 150 m at the western edge and finally to 300 m within the eddy; it then decreased to 135 m at the eastern edge. Surface temperature and salinity reached 25.6^{o}C and 36.45 ^{o}/oo within the warm core eddy. The temperature and salinity (T-S) characteristics of the upper water column (0-300m) within the eddy corresponded to those of Sargasso Sea Water, while the T-S characteristics of the lower water column (400-1000m) corresponded to those of Slope Water.

The clarity of the water was greater inside the warm core eddy than outside, indicating the presence of less particulate matter in the eddy water. A secchi disc measurement of 19.2 m was taken outside the eddy, while secchi disc readings of 31, 33, and 34.5 m were taken within and around the edge of the eddy. The depth of the 1% light level calculated for each station (from west to east, respectively) was 55 m, 99 m, 89 m, and 135 m.

The two eddy-edge stations exhibited very similar dissolved oxygen, phosphate, and chlorophyll profiles with depth (Fig. 9). Both exhibit a peak in dissolved oxygen at approximately 150 m, a decline in oxygen concentration to 600 m, and an increase in oxygen to a depth of 800-1000 m. Phosphate concentrations increased to a depth of 400-600 m and then decreased below that depth. The increase in oxygen at depth and the corresponding decrease in phosphate concentrations suggests that this deep water is of a relatively young age. The profiles obtained from outside the eddy exhibited a similar increase in oxygen from 400-1000 m, but no decrease in phosphate (Fig. 9).

Comparisons between stations within and outside the eddy reveal higher concentrations of dissolved oxygen outside the eddy, similar concentrations of phosphate shallower than 800 m, and higher concentrations of phosphate outside the eddy at 1000 m (Fig. 9). The cooler waters outside the eddy may have exhibited relatively high oxygen concentrations due to the greater capacity of cold water to hold oxygen in solution. The differences in phosphate concentration at depth suggest that the deep water under the warm core eddy was more recently at the surface or less organic matter is sinking from the surface of the eddy and undergoing decomposition.

The chlorophyll profiles obtained outside and within the warm core eddy exhibited a peak at approximately 25 m with concentrations decreasing to very low values below 100 m (Fig. 10). The peak chlorophyll concentrations measured within the edge of the eddy were twice that measured outside the eddy. This may have been due to a combination of horizontal mixing and/or upwelling of surrounding slope water and the presence of Sargasso Sea phytoplankters, the latter of which may have responded to the relatively high nutrient concentrations found in slope water as compared to Sargasso Sea water.

Water-Column Biology Studies:

Phytoplankton net, meter net and neuston net tows were conducted at three stations: 1) the western edge of the eddy, 2) the eastern edge, and 3) outside and to the east of the eddy. In contrast to the high abundance and low diversity of diatoms on Georges Bank, the warm core eddy exhibited a low abundance but high diversity of dinoflagellate species, including the genera *Peridinium*, *Ceratium*, and *Gymnodinium*. Dinoflagellates are mobile and smaller (with a higher surface to volume ratio) than diatoms, and as such, are better adapted for low nutrient waters.

A comparison of neuston tows conducted during the day and night within the warm core eddy revealed a slightly higher density of zooplankton at the surface during the night (Fig. 6). Myctophids were absent from the daytime tows, but accounted for approximately 20% of the biomass volume collected during the nightime tows, suggesting that these organisms undergo diurnal vertical migration.

Meter net tows revealed a higher density of zooplankton outside of the eddy than around the edges. Comparisons between net tows conducted on Georges Bank, within the warm core eddy, and in the Bay of Fundy revealed that, of the three areas, the eddy supported the lowest density of zooplankton, but the highest diversity and evenness (Fig. 5), indicating that the Sargasso Sea water of the warm core eddy is relatively oligotrophic compared with the shallow shelf waters of Georges Bank and the Bay of Fundy.

SCOTIAN SHELF

Sediment and Benthos Studies:

A shipek grab was obtained from each of 3 locations on the Scotian Shelf, including: 1) the western side of the Gully (a submarine canyon off Sable Island), at a depth of 203 m, 2) the eastern side of the Gully, at a depth of 246 m, and 3) the LaHave Basin, at a depth of 158 m. All 3 samples were well sorted and exhibited a grain size distribution dominated by fine sediments (Fig. 11). The west Gully sample was dominated by grains in the 125-250 um (42.5%), 62.5-125 um (36%), and < 62.5 um (15.4%) size fractions, the east Gully sample by grains in the 250-500 um (62.5%) and 125-250 um (15%) size fractions, and the LaHave Basin sample by grains less than 62.5 um (80%) in size. From these distributions, it would appear that the eastern side of the Gully is a slightly higher energy environment than the western side, and that the LaHave basin is the lowest energy environment of the 3 sample locations. The LaHave basin is a depression in the continental shelf and as such, is sheltered from direct exposure to shelf currents. Fine particles suspended in currents flowing above the basin settle out over time, resulting in a predominance of very fine sediments within the basin.

The majority of the sediment obtained in the 3 samples was terrigenous in nature, with feldspar accounting for a large fraction of the clay-size particles. Evidence of benthic biota, in the form of echinoderm and shell fragments, was found only at the Gully stations. Given the low energy, depositional environment of the LaHave Basin, it is reasonable to expect that a majority of the biota on the muddy bottom are soft-bodied deposit feeders.

BAY OF FUNDY

Physical-Chemical Studies:

Three stations were conducted across the mouth of the Bay of Fundy. These included a station on the eastern side of the bay, in the central bay, and on the western side of the bay. Hydrocasts were carried out at all three stations, with a successful CTD deployment conducted at the central and eastern stations, and secchi disc readings taken at the central and western stations.

The CTD cast performed at the eastern bay station revealed lower surface temperatures and lower overall salinities than those measured in the central bay (Fig. 12). The central bay also exhibited a more pronounced thermocline than did the eastern bay (Fig. 12), indicating that the central bay experiences less mixing than the eastern bay. This scenario corresponds well with the documented gyre-like circulation within the bay and the strengthening of eastern bay flood currents due to coriolis deflection.

Light penetration into the water column was similar to that measured on the eastern flank of Georges Bank. Secchi disc readings ranged from 9.9 to 10.4 m, giving 1% light penetration depths of 28 to 30 m at the western and central bay stations, respectively.

Hydrocasts were conducted at each of the 3 Bay of Fundy stations, allowing for comparisons of dissolved oxygen, phosphate, and chlorophyll *a* concentrations across the bay. The eastern and western stations exhibited very similar oxygen profiles, with concentration peaking at 28 m and then decreasing with depth (Fig. 13). The chlorophyll *a* profiles for these stations also exhibited a peak at a depth of around 25 m (Fig. 13), suggesting that the high oxygen values were due to photosynthesizing phytoplankton located just above the 1% light level (28 m). The profiles for the central station revealed a similar correlation between oxygen and chlorophyll concentrations, with both peaking at a depth of approximately 10 m. Given the presence of a pycnocline at 10 m, it is probable that the high oxygen values were due to an accumulation of phytoplankton at the density interface. Phosphate concentrations also peaked at 10 m in the central bay, suggesting a favorable nutrient regime for the phytoplankters.

Water-Column Biology Studies:

A phytoplankton net and neuston net tow were conducted at all 3 Bay of Fundy stations, while a meter net tow was performed only at the central and western bay stations. A qualitative examination of the phytoplankton net samples revealed a relatively low diversity of phytoplankters, consisting mostly of the dinoflagellate *Ceratium* along with a few individuals of the diatom *Chaetoceros.* The diversity of the samples appeared to be similar to that found on Georges Bank, and much lower than that found in the warm core eddy. These results provide further evidence that the shelf waters off the New England coast are more productive than the offshore warm-core-eddy waters derived from the Sargasso Sea.

The neuston tows again collected a higher density of zooplankton during the night than during the day (Fig. 6). Myctophids, observed to vertically migrate within the warm core eddy, were absent from all of the Bay of Fundy neuston tows. Myctophids are typically found offshore and are probably rare within the estuarine environment of the Bay of Fundy.

The average density of zooplankton collected in the Bay of Fundy meter net and neuston net tows was higher than that obtained within the warm core eddy, and lower than that obtained on Georges Bank, indicating an intermediate amount of secondary production (Fig. 5). The diversity and evenness indices calculated for the bay were lower than those calculated for both the warm core eddy and Georges Bank, revealing the bay to be dominated by fewer zooplankton species than the other two areas (Fig. 5).

Sediment and Benthos Studies:

A shipek grab was conducted at each of the 3 Bay of Fundy stations: 1) the eastern bay, off the southwestern tip of Nova Scotia at a depth of 117 m, 2) the central bay, at a depth of 176 m, and 3) the western bay, southwest of Grand Manan Island at a depth of 111 m. The eastern bay sample was fairly well sorted, with a majority of the grains ranging in size from 250 to 1000 um (73%) (Fig. 14). The larger grain sizes consisted of bivalve shell fragments, quartz, shale, and feldspar, while the smaller grains consisted mostly of quartz and feldspar. The central bay sample exhibited a bimodal grain-size distribution with 38% of the grains greater than 3000 um and 30.8% less than 62.5 um. Upon taking the sample, a large rock got jammed in between the bucket and the grab so that the sample was exposed as the grab was brought to the surface. It is believed that this resulted in a winnowing away of a good portion of fine sediments. Had the bucket completely closed, there would have been a much higher percentage of fines and subsequently a lower percentage of gravel. The sample obtained from the western bay was very well sorted, with 86% of the sample consisting of grains less than 62.5 um (Fig. 14).

The transect across the Bay of Fundy revealed a high variability in grain size within a short distance and a gradient of relatively high to low energy as one crossed from east to west across the bay. This correlates well with the counterclockwise circulation pattern known to exist in the bay. Water flowing into the bay gets deflected to the east due to Coriolis, resulting in strong flows along the eastern shore of the bay. The southerly flow along the western side of the bay is deflected to either side of Grand Manan Island. This deflected flow, in combination with the larger counterclockwise current of the Gulf of Maine, creates a small clockwise gyre to the southwest of the island. The currents within this gyre are relatively weak, resulting in a low energy, depositional environment.

The only benthic biota scooped up by the grabs in the Bay of Fundy included several polychaete worms and a bivalve.

INDICATOR ORGANISMS

The distributions of 4 planktonic organisms were mapped throughout the cruise track to determine whether any of the 4 were indicative of specific areas or water masses. The percentage of chaetognaths, pteropods, fish eggs and larvae, and crab larvae collected at each station was recorded and later plotted to look at their geographical patterns of abundance.

The highest percentage of chaetognaths (6-12%) was found on Georges Bank. Chaetognaths are known to be voracious zooplankton predators. Given that Georges Bank exhibited the highest zooplankton densities of any of the regions sampled on the cruise, it would appear that chaetognath abundance is directly linked to the abundance of their prey.

Pteropods were most abundant (8-18%) over the Scotian Shelf and east of Sable Bank in Scotian Shelf water. Fish eggs and larvae had a more widespread distribution, accounting for over 15% of the 100 counts at 7 stations including the eastern flank of Georges Bank, the western edge of the warm core eddy, east and west of Sable Island, the Scotian Shelf, and the central Bay of Fundy. Fish eggs and larvae appear to be poor indicators of a given location (i.e. inshore vs. offshore) or water mass. Fish eggs were more abundant than fish larvae at all but one of the stations sampled along the cruise track. That station was located west of Sable Island and to the northeast of a front marked by a change in water color and sea state. We sampled both sides of the front and found the station southwest of the front to be dominated by fish eggs and the station northeast of the front to be dominated by fish larvae. The blue water to the northeast of the front exhibited a surface temperature of 16.8^{o}C, while the greener water to the southwest of the front exhibited a surface temperature of 14.3^{o}C, suggesting the presence of two different water masses.

Crab larvae were abundant on the surface at night around Nantucket Shoals and Georges Bank (accounting for 36-62% and 45-70% of the zooplankton, respectively), providing further evidence that these larvae vertically migrate. The only station to exhibit a high abundance of crab larvae at the surface during the daytime was one located west of Sable Island and to the northeast of the front mentioned above. Crab larvae accounted for 26% of the zooplankton collected to the northeast of the front, but only 3% to the southwest of the front, again indicating that the front was a boundary between two different water masses.

Finally, it became apparent during our cruise that *Sargassum* is a good indicator of Sargasso Sea water intrusion (i.e. warm core eddies) within the northwest Atlantic. Organisms found associated with *Sargassum* included pteropods, amphipods, shrimp, cnidarian medusae, mysids, salps, myctophids, fish larvae and eggs, nudibranchs, hydroids, euphausids, crab larvae, portunid crabs, file and pompano fish, stomatopods, sea stars, ostracods, and chaetognaths. The *Sargassum* rafts represent oases of life in the otherwise oligotrophic waters of the Sargasso Sea and newly-formed warm core eddies.

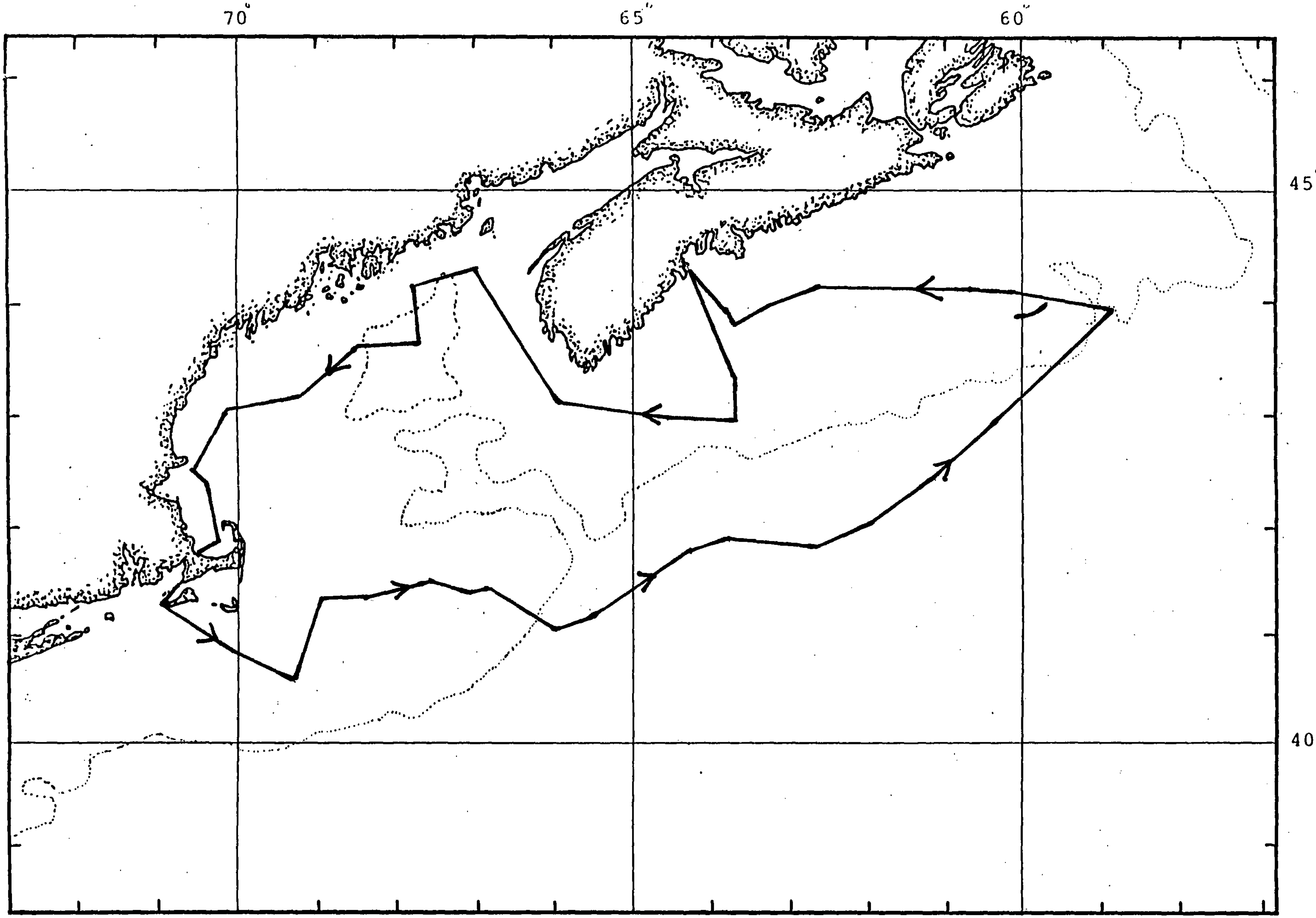

Fig. 1: W-134 cruise track.

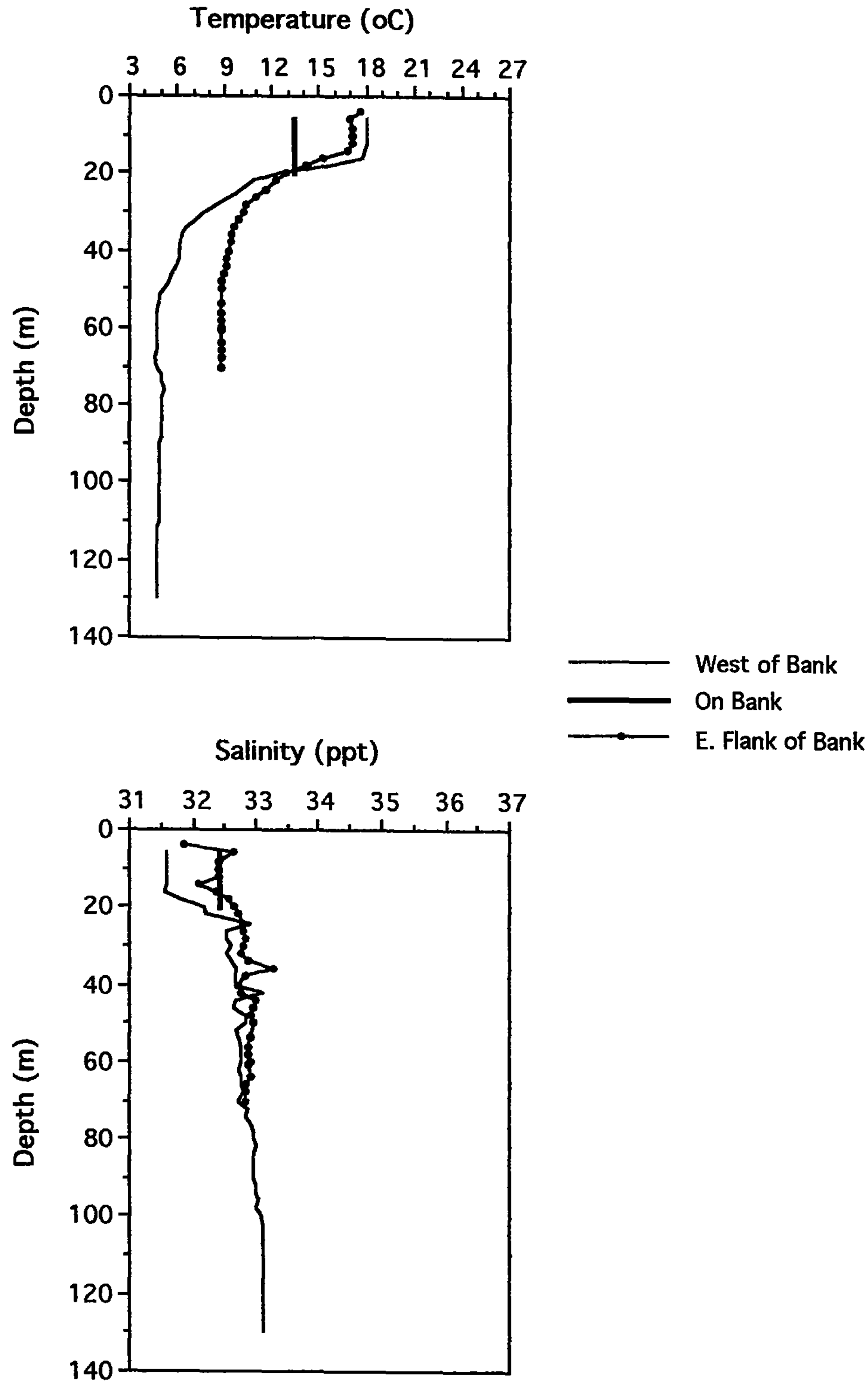

Fig. 2: Temperature and salinity profiles obtained west of Georges Bank, on a shallow region of the bank, and on the eastern flank of Georges Bank.

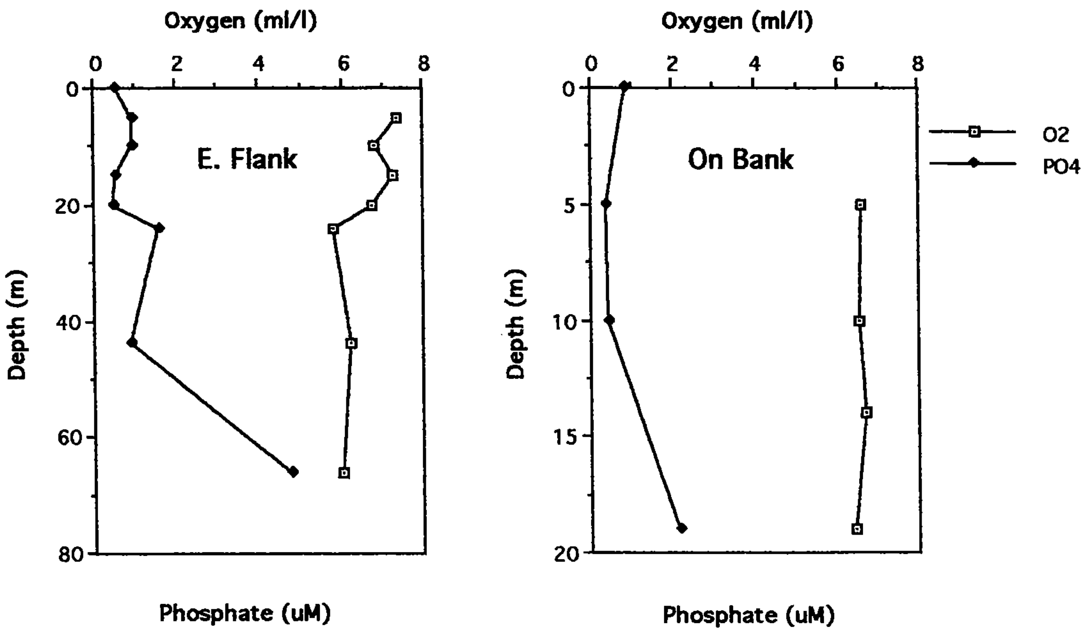

Fig. 3: Oxygen and phosphate concentration with depth at stations on the eastern flank and central region of Georges Bank.

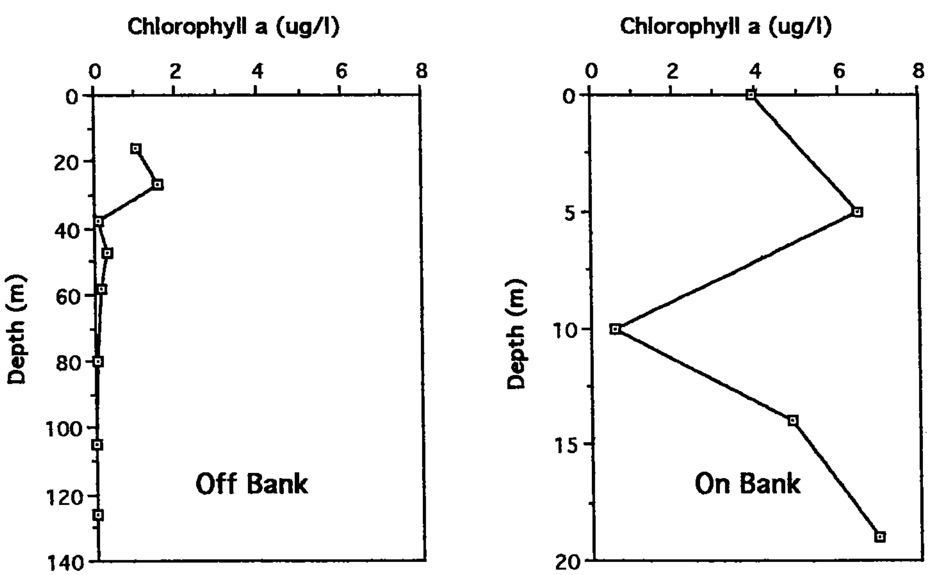

Fig. 4: Chlorophyll *a* concentration with depth at stations to the west of and on Georges Bank.

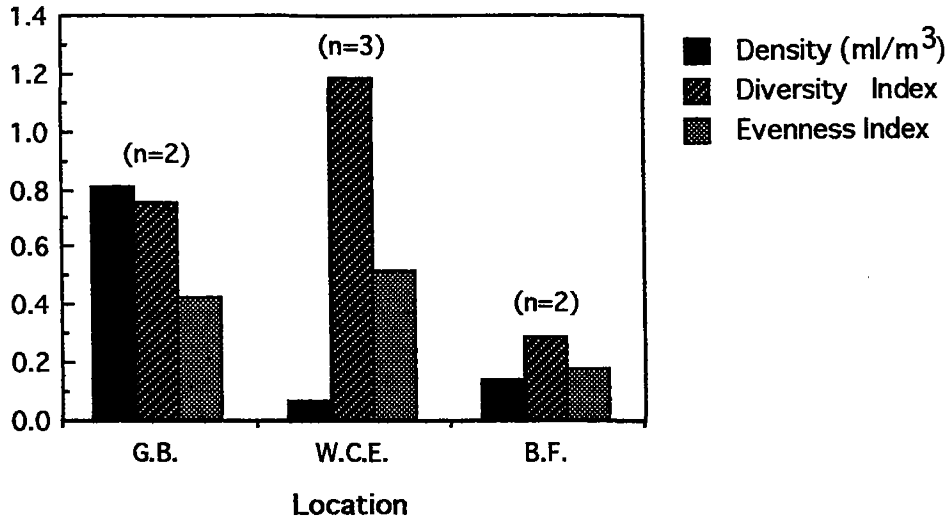

Fig. 5: Average density, diversity, and evenness of zooplankton collected in meter net tows on Georges Bank (G.B.), within a warm core eddy (W.C.E.), and in the Bay of Fundy (B.F.).

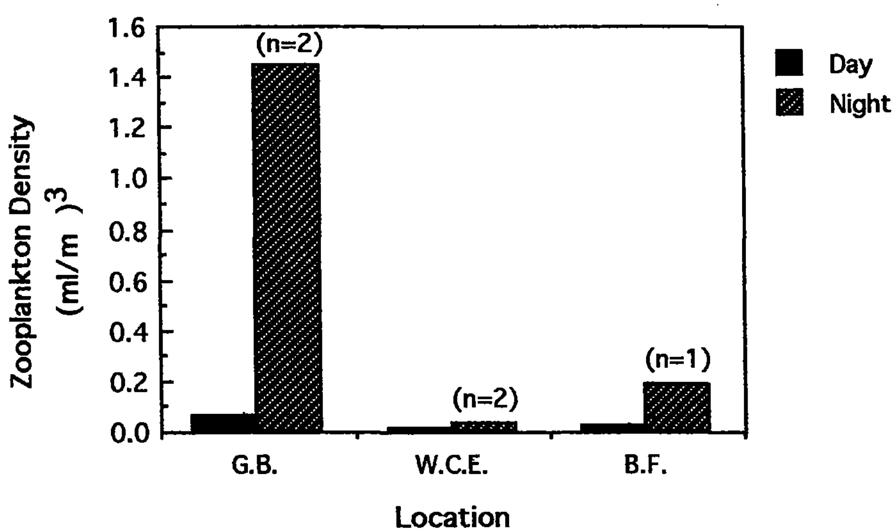

Fig. 6: Average zooplankton density obtained from neuston net tows conducted during the day and night on Georges Bank (G.B.), within a warm core eddy (W.C.E.), and in the Bay of Fundy (B.F.).

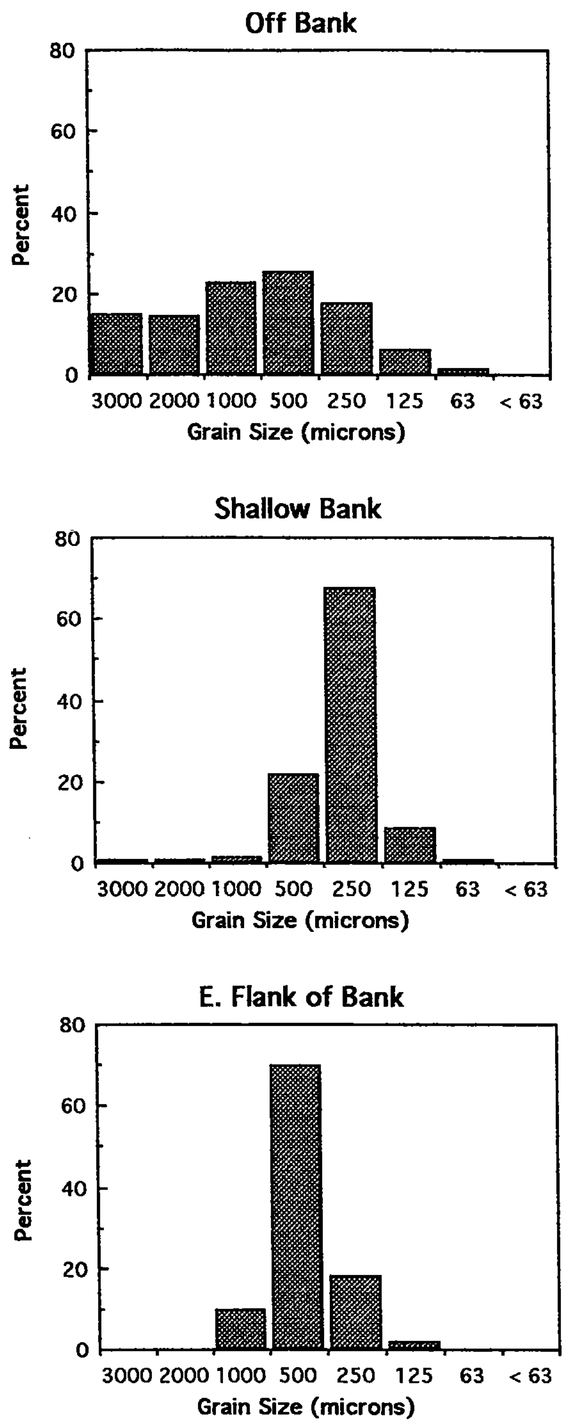

Fig. 7: Grain size distribution of sediment collected to the west of Georges Bank, on a shallow region of the bank, and on the eastern flank of Georges Bank.

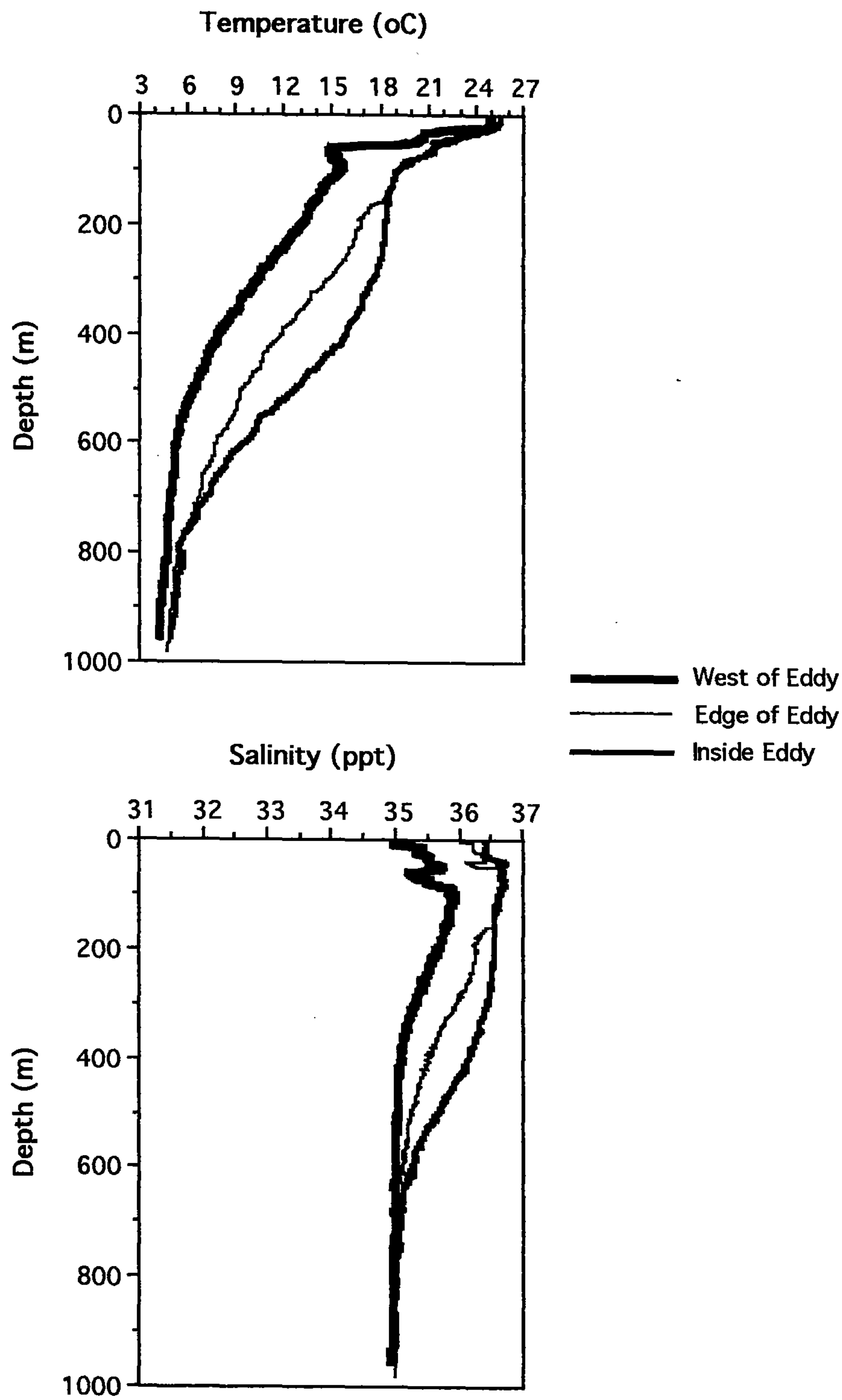

Fig. 8: Temperature and salinity profiles obtained to the west of a warm core eddy, on the edge of the eddy, and inside the eddy.

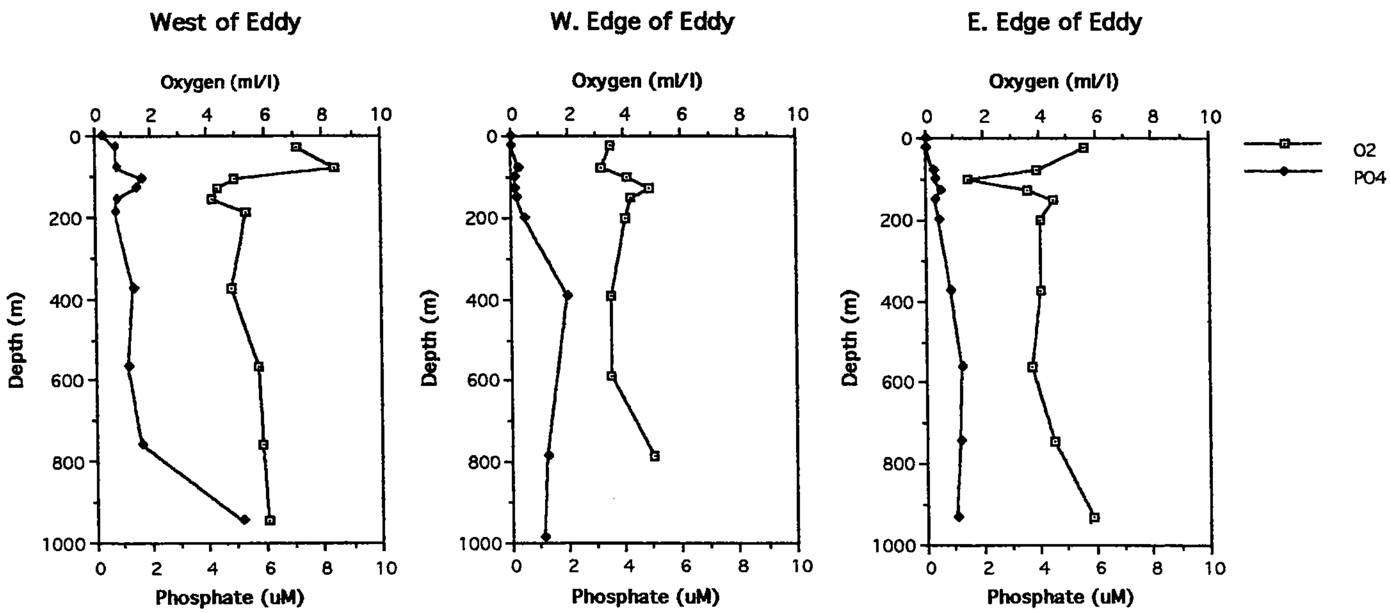

Fig. 9: Oxygen and phosphate concentration with depth at stations to the west of a warm core eddy, on the western edge of the eddy, and on the eastern edge of the eddy.

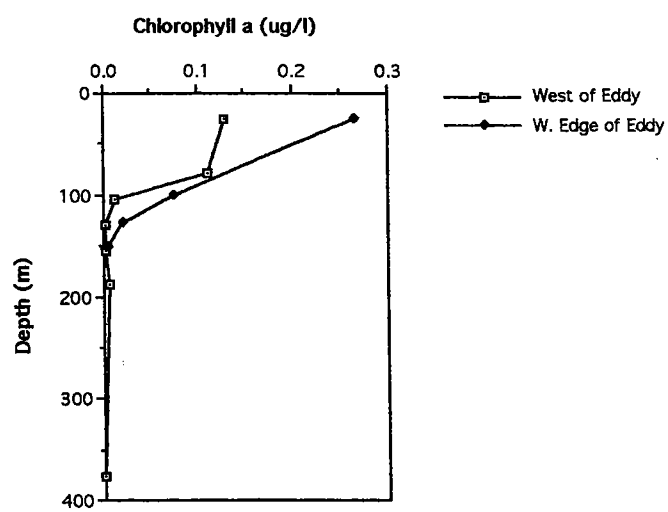

Fig. 10: Chlorophyll a concentration with depth at stations to the west of a warm core eddy and within the western edge of the eddy.

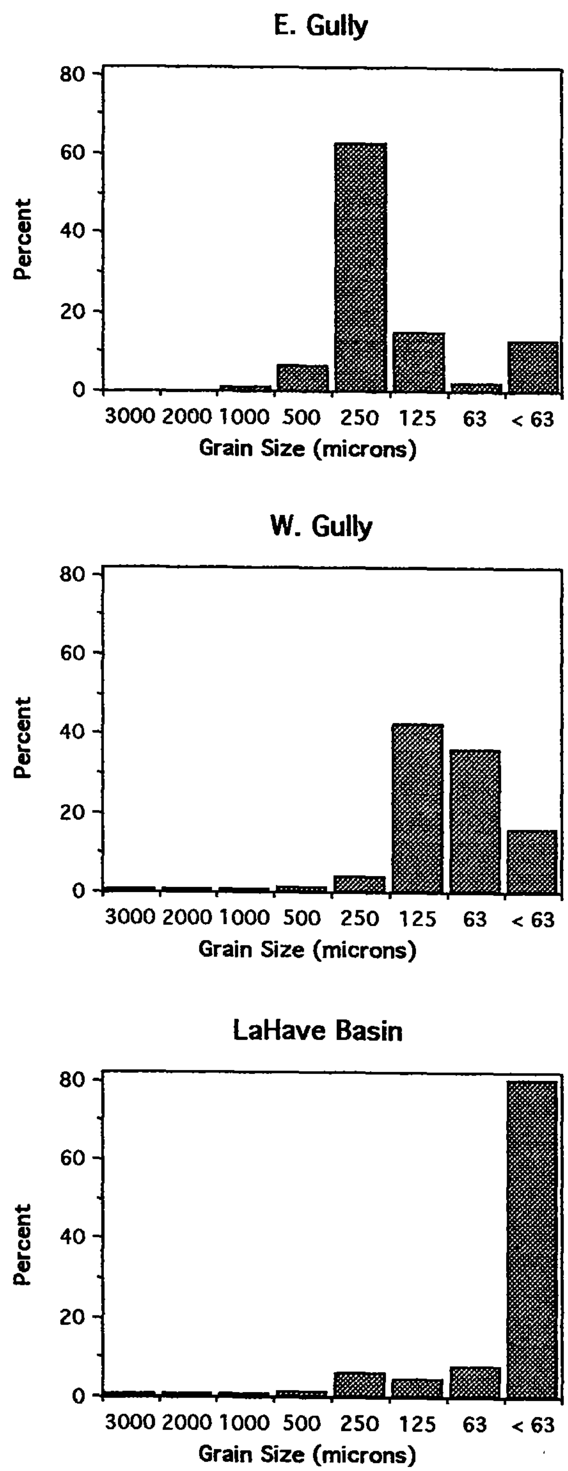

Fig.11: Grain size distribution of sediment collected at the eastern edge of the Gully, the western edge of the Gully, and in the LaHave Basin.

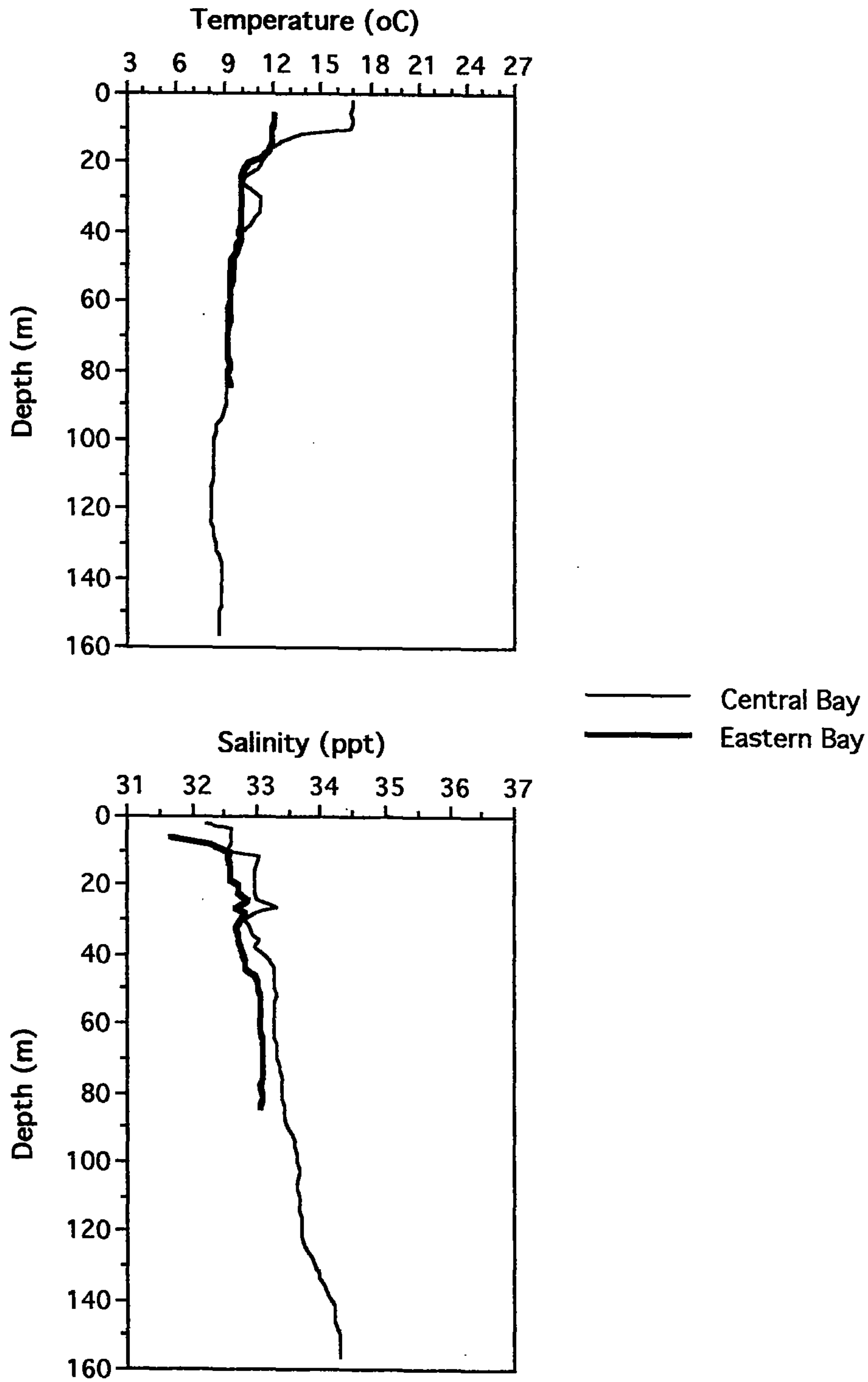

Fig. 12: Temperature and salinity profiles recorded in the central and eastern Bay of Fundy.

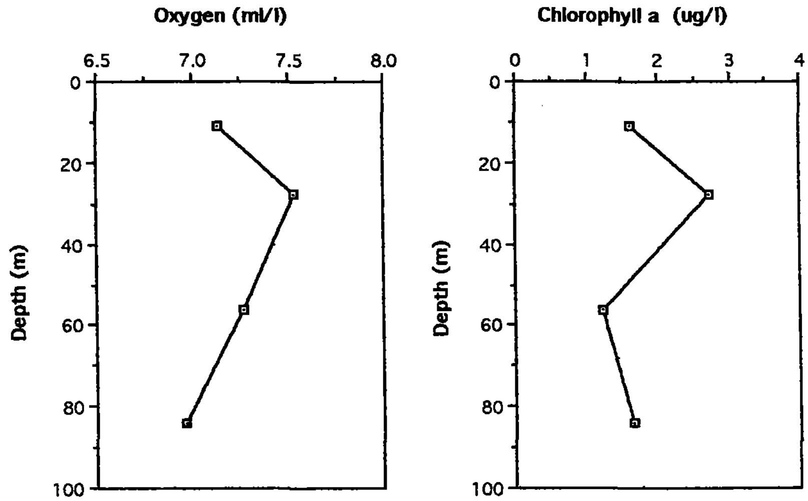

Fig. 13: Oxygen and chlorophyll a concentration with depth at a station in the eastern Bay of Fundy.

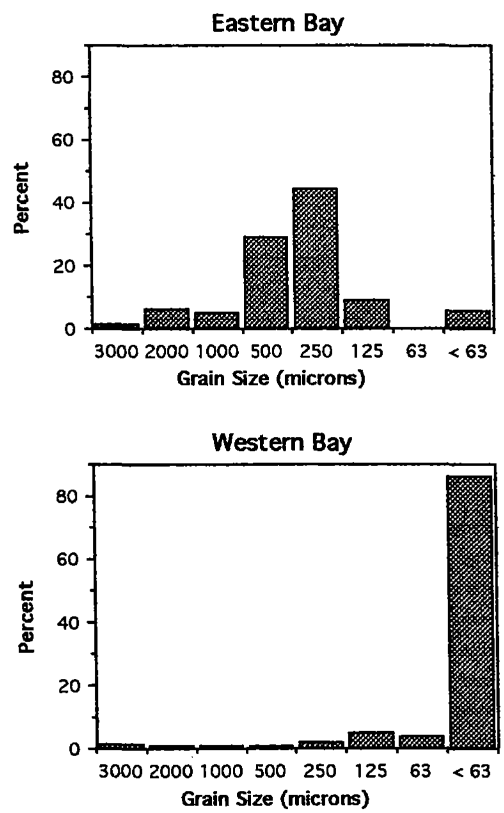

Fig. 14: Grain size distribution of sediment collected in the eastern and western Bay of Fundy.

Appendix 1. W-134 Hydrocast Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Bottle #	Depth (m)	Temp. (oC)	Salinity (o/oo)	PO4 (uM)	Chl. a (ug/l)	O2 (ml/l)
W-134 -003	07-Jul-94	1551	97.0	40.31	69.12	S. of Nantucket Shoals	1	30	9.72	33.40	0.475	2.531	7.07
							2	20	9.89	33.11	0.598	0.262	5.62
W-134 -005	08-Jul-94	1100	131.5	41.16	69.01	W. of Georges Bank	1	126	4.80	33.11	0.849	0.012	6.38
							2	105	4.80	33.11	0.153	0.001	6.12
							3	80	5.00	32.99	0.941	0.049	6.60
							4	58	4.76	32.75	----------	0.155	6.74
							5	47	4.88	32.72	1.441	0.326	6.59
							6	38	6.06	32.71	----------	0.122	6.73
							7	27	7.16	32.52	0.378	1.553	7.39
							8	16	11.10	32.25	0.272	1.051	6.43
							9	0	18.06	31.56	0.462	----------	----------
W-134 -008	09-Jul-94	0740	192.3	41.22	67.35	On Georges Bank	1	19	13.57	32.45	2.128	6.967	6.43
							2	14	13.57	32.45	----------	4.873	6.70
							3	10	13.57	32.45	0.399	0.599	6.55
							4	5	13.57	32.45	0.352	6.469	6.57
							5	0	13.57	32.45	0.852	3.921	----------
W-134 -010	10-Jul-94	0725	236.3	41.16	66.44	E. Flank of Georges Bank	1	66	8.79	32.84	4.745	0.391	6.03
							2	44	8.84	32.91	0.890	0.313	6.20
							3	24	10.21	32.83	1.547	0.738	5.79
							4	20	11.50	32.84	0.484	3.578	6.74
							5	15	13.05	32.87	0.530	0.854	7.28
							6	10	16.15	32.06	0.928	0.496	6.78
							7	5	17.10	32.41	0.916	0.565	7.36
							8	0	17.11	32.41	0.517	0.567	----------
W-134 -011	10-Jul-94	1740	257.7	41.11	66.19	Shelf Break	1	155	12.51	35.45	0.750	0.031	2.30
							2	96	13.23	35.46	1.043	0.044	2.76
							3	48	13.01	34.38	0.488	0.333	3.21
							4	24	15.92	34.23	0.348	1.570	3.10
							5	10	22.79	33.54	0.458	0.034	----------
							6	0	23.15	33.54	0.306	0.217	6.38

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Bottle #	Depth (m)	Temp. (oC)	Salinity (o/oo)	PO4 (uM)	Chl. a (ug/l)	O2 (ml/l)
W-134 -014	11-Jul-94	1132	306.0	41.05	65.24	W. of Warm Core Eddy	1	947	4.38	34.98	5.139	----------	6.05
							2	757	4.85	35.02	1.627	----------	5.89
							3	564	5.66	35.03	1.174	----------	5.74
							4	376	9.51	35.24	1.369	0.000	4.83
							5	188	13.37	35.71	0.708	0.006	5.39
							6	156	13.32	35.67	0.763	0.002	4.21
							7	130	14.21	35.83	1.500	0.001	4.38
							8	104	14.94	35.88	1.716	0.012	4.98
							9	78	15.85	35.82	0.776	0.112	8.40
							10	26	20.86	35.56	0.700	0.130	7.10
							11	0	25.13	35.46	0.229	----------	----------
W-134 -016	12-Jul-94	0600	356.9	41.31	64.18	W. Edge of Warm Core Eddy	1	988	4.74	35.00	1.129	----------	----------
							2	784	5.55	35.03	1.258	----------	5.01
							3	588	7.92	35.11	----------	----------	3.51
							4	392	11.92	35.54	1.990	----------	3.54
							5	203	16.66	36.26	0.454	----------	4.06
							6	152	18.24	36.52	0.196	0.003	4.27
							7	127	18.64	36.59	0.138	0.020	4.90
							8	100	19.12	36.69	0.103	0.075	4.15
							9	76	20.32	36.72	0.276	----------	3.20
							10	25	23.90	36.39	0.014	0.265	3.56
							11	0	25.46	36.23	0.014	----------	----------
W-134 -020	13-Jul-94	0430	392.0	41.48	62.55	E. Edge of Warm Core Eddy	1	933	4.71	34.98	1.076	----------	5.86
							2	746	5.46	35.02	1.164	----------	4.52
							3	560	7.50	35.10	1.253	----------	3.73
							4	373	12.27	35.56	0.853	----------	4.06
							5	202	16.69	36.28	0.432	0.005	4.04
							6	151	17.20	36.32	0.321	0.001	4.51
							7	126	18.34	36.54	0.547	0.004	3.57
							8	101	18.68	36.55	0.338	0.028	1.50
							9	76	19.40	36.28	0.245	0.044	3.94
							10	25	24.23	35.92	0.000	0.238	5.64
							11	0	25.68	36.18	0.000	0.408	----------

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Bottle #	Depth (m)	Temp. (oC)	Salinity (o/oo)	PO4 (uM)	Chl. a (ug/l)	O2 (ml/l)
W-134 -022	13-Jul-94	2123	424.0	41.59	61.57	Outside of Warm Core Eddy	1	978	4.15	34.94	0.965	0.006	----------
							2	782	4.59	34.97	0.996	0.052	5.40
							3	587	5.78	35.02	0.947	0.000	4.75
							4	391	8.34	35.11	1.409	0.015	3.26
							5	203	12.21	35.55	0.862	0.001	3.75
							6	152	13.53	35.73	0.685	0.004	4.43
							7	127	14.17	35.77	0.720	0.004	2.32
							8	102	14.69	35.86	0.551	0.015	4.38
							9	76	14.61	35.70	0.538	0.080	1.77
							10	25	19.21	35.58	----------	0.276	3.63
							11	0	22.44	34.04	0.050	----------	2.94
W-134 -028	18-Jul-94	0734	756.0	44.06	62.25	Scotian Shelf	1	137	9.37	34.55	1.133	0.009	1.69
							2	---------	----------	----------	----------	----------	----------
							3	95	7.23	33.87	0.960	0.034	1.14
							4	74	4.48	32.99	0.867	0.108	2.09
							5	53	3.61	32.78	0.769	0.858	2.55
							6	32	6.37	32.23	0.427	0.940	----------
							7	21	8.65	31.85	0.654	0.212	2.87
							8	11	17.85	31.10	0.356	0.278	----------
							9	0	17.91	31.09	0.236	0.243	5.67
W-134 -029	19-Jul-94	0540	808.7	43.52	63.35	LaHave Basin	1	180	10.09	35.00	----------	0.006	2.47
							2	135	9.71	34.77	----------	0.007	3.05
							3	90	7.16	33.92	----------	0.065	4.65
							4	45	4.87	31.90	----------	0.043	----------
							5	27	9.81	29.70	----------	0.523	7.38
							6	9	21.37	28.44	----------	0.307	5.66
							7	0	17.93	30.77	----------	1.357	5.70
W-134 -030	26-Jul-94	0102	1081.1	43.53	66.38	Eastern Bay of Fundy	1	84	9.38	33.10	0.742	1.657	6.96
							2	56	9.37	33.09	0.664	1.233	7.26
							3	28	10.01	32.73	0.484	2.728	7.53
							4	11	11.89	32.69	0.469	1.622	7.14
							5	0	12.12	31.50	0.435	----------	----------

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Bottle #	Depth (m)	Temp. (oC)	Salinity (o/oo)	PO4 (uM)	Chl. a (ug/l)	O2 (ml/l)
W-134 -031	26-Jul-94	0740	1102.8	44.15	66.51	Central Bay of Fundy	1	158	8.70	34.29	1.205	0.006	5.75
							2	132	8.60	33.96	1.195	0.008	5.49
							3	106	8.40	33.64	1.054	0.225	6.14
							4	79	9.23	33.38	0.815	0.183	6.51
							5	53	9.52	33.26	0.776	0.678	6.65
							6	26	11.21	32.75	0.601	1.562	6.77
							7	11	15.48	32.35	1.039	3.681	7.49
							8	0	16.88	32.61	0.498	0.861	----------
W-134 -032	26-Jul-94	1607	1118.9	44.23	67.19	Western Bay of Fundy	1	100	----------	----------	0.820	0.726	6.45
							2	75	----------	----------	0.956	0.699	6.52
							3	50	----------	----------	0.615	0.776	6.61
							4	25	----------	----------	0.820	1.038	7.09
							5	10	11.06	32.64	0.888	0.861	6.74
							6	0	11.36	32.69	0.791	1.883	----------

Appendix 2. W-134 Bathythermograph Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Surface Temp. (oC)
BT-001	07-Jul-94	1448	96.0	40.31	69.13	22.5
BT-002	08-Jul-94	0830	128.9	41.10	69.05	17.9
BT-003	08-Jul-94	1017	131.5	41.16	69.02	18.4
BT-004	10-Jul-94	0450	232.4	41.15	66.45	16.6
BT-005	10-Jul-94	1515	251.5	41.15	66.30	17.8
BT-006	10-Jul-94	1630	256.0	41.11	66.21	22.8
BT-007	10-Jul-94	1755	257.8	41.10	66.18	22.6
BT-008	10-Jul-94	1930	261.0	41.08	66.15	23.0
BT-009	10-Jul-94	2336	273.3	41.02	65.59	24.4
BT-010	11-Jul-94	0250	281.0	40.58	65.50	24.6
BT-011	11-Jul-94	0540	291.1	40.55	65.38	23.8
BT-012	11-Jul-94	0952	301.2	41.01	65.26	24.1
BT-013	11-Jul-94	1830	317.0	41.09	65.08	24.0
BT-014	11-Jul-94	2100	327.5	41.14	64.55	25.0
BT-015	11-Jul-94	2310	335.0	41.19	64.46	25.4
BT-016	12-Jul-94	0054	340.0	41.23	64.41	25.3
BT-017	12-Jul-94	0230	345.2	41.25	64.34	24.4
BT-018	12-Jul-94	0335	350.0	41.27	64.28	23.4
BT-019	12-Jul-94	0400	352.0	41.28	64.25	23.4
BT-020	12-Jul-94	0435	353.5	41.29	64.23	24.5
BT-021	12-Jul-94	0510	355.9	41.30	64.20	25.0
BT-022	12-Jul-94	0929	357.9	41.38	64.14	25.1
BT-023	12-Jul-94	1030	362.8	41.40	64.80	24.3
BT-024	12-Jul-94	1130	365.4	41.42	64.03	24.3
BT-025	12-Jul-94	1230	367.5	41.43	63.59	25.4
BT-026	12-Jul-94	1350	379.5	41.45	63.54	25.4
BT-027	12-Jul-94	1625	373.5	41.43	63.44	25.4
BT-028	12-Jul-94	2255	379.9	41.46	63.23	25.0
BT-029	13-Jul-94	0005	382.5	41.47	63.16	25.8
BT-030	13-Jul-94	0205	388.0	41.48	63.04	25.1
BT-031	13-Jul-94	0115	391.2	41.48	62.57	25.2
BT-032	13-Jul-94	1245	400.6	41.43	62.33	20.6
BT-033	13-Jul-94	1607	410.0	41.49	62.19	21.9
BT-034	13-Jul-94	1941	420.0	41.56	62.04	22.8
BT-035	14-Jul-94	0428	439.3	41.08	61.35	20.3
BT-036	14-Jul-94	0732	449.3	42.14	61.22	19.9
BT-037	14-Jul-94	1045	459.0	42.21	61.10	20.2
BT-038	14-Jul-94	1101	460.6	42.22	61.09	20.2
BT-039	14-Jul-94	1650	481.3	42.32	60.44	20.7
BT-040	25-Jul-94	2200	1057.2	43.24	66.15	11.4
BT-041	25-Jul-94	2327	1074.2	43.44	66.32	12.4

Appendix 3. W-134 CTD Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Cast Depth (m)	Locale
W-134 -003	07-Jul-94	1551	97.0	40.31	69.12	50	S. of Nantucket Shoals
W-134 -005	08-Jul-94	1105	131.5	41.16	69.00	120	W. of Georges Bank
W-134 -008	09-Jul-94	0750	192.2	41.21	67.34	25	On Georges Bank
W-134 -010	10-Jul-94	0745	236.3	41.16	66.45	65	E. Flank of Georges Bank
W-134 -011	10-Jul-94	1740	257.7	41.10	66.18	150	Shelf Break
W-134 -012	10-Jul-94	2020	263.5	41.16	66.11	1000	Slope
W-134 -014	11-Jul-94	1132	306.2	41.04	65.23	1000	W. of Warm Core Eddy
W-134 -016	12-Jul-94	0600	356.9	41.31	64.18	1000	Edge of Warm Core Eddy
W-134 -018	12-Jul-94	1720	374.5	41.43	63.42	1000	Warm Core Eddy
W-134 -020	13-Jul-94	0430	392.0	41.47	62.54	1000	E. Edge of Warm Core Eddy
W-134 -022	13-Jul-94	2123	424.0	41.59	61.57	1000	E. of Warm Core Eddy
W-134 -024	15-Jul-94	1757	470.4	43.53	59.03	150	W. Edge Gully: Sable Is. Bank
W-134 -028	18-Jul-94	0734	756.0	44.07	62.25	130	Scotian Shelf
W-134 -029	19-Jul-94	0540	808.7	43.52	63.35	200	LaHave Basin
W-134 -030	26-Jul-94	0102	1081.1	43.53	66.39	75	Eastern Bay of Fundy
W-134 -031	26-Jul-94	0737	1102.8	44.15	66.52	150	Central Bay of Fundy
W-134 -032	26-Jul-94	1607	1118.9	44.24	67.20	100	Western Bay of Fundy
W-134 -033	26-Jul-94	2100	1124.0	44.22	67.41	45	Northern Gulf of Maine

Appendix 4. W-134 Meter Net Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Tow Depth (m)	Total Flow	Zpl. Biomass (ml)	Zpl. Density (ml/m3)
W-134 -005	08-Jul-94	1636	131.8	41.14	68.59	W. of Georges Bank	100	72447	2446	1.61
W-134--008	09-Jul-94	0835	192.2	41.21	67.34	On Georges Bank	15	35992	850	1.13
W-134--010	10-Jul-94	0955	236.9	41.19	66.49	E. Flank of Georges Bank	60	41533	425	0.49
W-134 -014	11-Jul-94	1357	306.7	41.05	65.19	W. of Warm Core Eddy	350	100188	125	0.06
W-134 -016	12-Jul-94	0823	357.2	41.35	64.17	W. Edge of Warm Core Edd	100	56196	60	0.05
W-134 -020	13-Jul-94	0728	392.0	41.44	62.49	E. Edge of Warm Core Eddy	100	32059	60	0.09
W-134 -022	14-Jul-94	0019	424.6	42.00	61.55	Outside of Warm Core Eddy	100	38696	114	0.14
W-134 -028	18-Jul-94	0195	756.4	44.06	62.27	Scotian Shelf	100	43043	200	0.22
W-134 -031	26-Jul-94	0940	1103.5	44.17	66.54	Central Bay of Fundy	50	37419	150	0.19
W-134 -032	26-Jul-94	1744	1119.1	44.23	67.24	Western Bay of Fundy	50	36535	63	0.82

Appendix 5. W-134 Neuston Tow Data

Station	Date	Time	Surface Temp. (oC)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Tow Distance (m)	Zpl. Biomass (ml)	Tar Bits	Plastic Pieces	S. fluitans (gm)	Myctophid (no.)
W-134 -001	07-Jul-94	0010	19.5	44.8	40.48	70.07	NW of Nantucket Shoals	1852	> 1500	0	0	0	4
W-134 -002	07-Jul-94	1210	22.0	90.3	40.32	69.20	S. of Nantucket Shoals	1667	10	0	2	1	0
W-134 -004	08-Jul-94	0025	16.7	113.0	40.55	69.05	S. of Nantucket Shoals	1852	312	0	0	0	0
W-134 -006	08-Jul-94	0010	19.6	133.4	41.13	68.57	W. of Georges Bank	1482	0	0	0	0	0
W-134 -007	09-Jul-94	0000	14.2	159.1	41.20	68.21	W. Slope of Georges Bank	1481	485	0	1	0	0
W-134 -008	09-Jul-94	0943	29.0	193.2	41.20	67.36	0n Georges Bank	1852	154	0	0	0	0
W-134 -009	10-Jul-94	0012	16.7	218.6	41.20	67.08	On Georges Bank	741	1900	0	0	0	0
W-134 -010	10-Jul-94	1045	17.1	237.5	41.20	66.51	On Georges Bank	1852	85	1	9	0	0
W-134 -013	11-Jul-94	0015	24.3	275.9	41.01	65.57	E. of Georges Bank	2778	82	0	0	0	117
W-134 -014	11-Jul-94	1132	24.8	306.0	41.04	65.23	W. of Warm Core Eddy	1852	25	0	1	260	0
W-134 -015	12-Jul-94	0030	25.4	338.5	41.21	64.43	W. Edge of Warm Core Edd	1852	70	8	0	0	25
W-134 -017	12-Jul-94	1225	25.4	367.5	41.44	63.60	W. Edge of Warm Core Edd	1852	20	0	2	15	0
W-134 -019	13-Jul-94	0000	25.8	382.0	41.48	63.47	Warm Core Eddy	1852	40	0	0	200	14
W-134 -021	13-Jul-94	1206	20.8	399.3	41.43	62.36	E. Edge of Warm Core Eddy	1852	28	0	0	0	0
W-134 -023	14-Jul-94	1150	20.6	463.0	42.23	61.05	Outside of Warm Core Eddy	1852	6	0	1	235	0
W-134 -026	17-Jul-94	1200	16.8	678.8	44.04	60.36	Scotian Shelf: NE of Front	1852	18	> 20	26	0	0
W-134 -026	17-Jul-94	1330	16.8	680.5	44.04	60.36	Scotian Shelf: SW of Front	1481	3	1	1	0	0
W-134 -027	18-Jul-94	0002	18.2	721.0	44.07	61.29	E. of Sable Bank	1111	22	0	0	0	0
W-134 -028	18-Jul-94	1200	19.1	760.0	44.04	62.36	Scotian Shelf	1481	2	0	0	0	0
W-134 -030	26-Jul-94	0308	14.8	1082.8	43.58	66.42	Eastern Bay of Fundy	1852	340	0	0	70	0
W-134 -031	26-Jul-94	1028	17.4	1104.8	44.17	66.56	Central Bay of Fundy	370	9	0	4	0	0
W-134 -032	26-Jul-94	1829	11.5	1120.3	44.23	67.28	Western Bay of Fundy	1667	-------------	0	0	205	0

Appendix 6. W-134 Phytoplankton Net Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Qualitative Description
W-134-005	08-Jul-94	1120	131.5	41.16	69.01	W. of Georges Bank	Copepods
W-134 -008	09-Jul-94	0724	192.2	41.21	67.34	On Georges Bank	Copepods, Algae, Diatoms
W-134 -010	10-Jul-94	0852	236.3	41.17	66.46	E. Flank of Georges Bank	Dinoflagellates
W-134 -014	11-Jul-94	1352	306.6	41.05	65.20	W. of Warm Core Eddy	Diatoms, Trichodesmium
W-134 -016	12-Jul-94	1614	357.0	41.31	64.17	W. Edge of Warm Core Eddy	Small Copepods, Dinoflagellates
W-134 -020	13-Jul-94	0440	392.0	41.47	41.48	E. Edge of Warm Core Eddy	Dinoflagellates, Diatoms, Chaetognaths
W-134 -022	13-Jul-94	2123	424.0	41.59	61.57	NE of Warm Core Eddy	Cyanobacteria, Diatoms
W-134 -028	18-Jul-94	0824	756.1	44.07	62.26	Scotian Shelf	
W-134 -030	26-Jul-94	0055	1081.1	43.53	66.39	Eastern Bay of Fundy	Cnidarian Medusae
W-134 -031	26-Jul-94	0727	1102.8	44.15	66.51	Central Bay of Fundy	
W-134 -032	26-Jul-94	1610	1118.9	44.23	67.20	Western Bay of Fundy	

Appendix 7. W-134 Shipek Grab Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Locale	Depth (m)
W-134 -005	08-Jul-94	1215	131.5	41.16	69.00	W. of Georges Bank	143
W-134 -008	09-Jul-94	0819	192.2	41.21	67.34	On Georges Bank	30
W-134 -010	10-Jul-94	0840	236.3	41.17	66.46	E. Flank of Georges Bank	75
W-134 -024	15-Jul-94	1757	470.4	43.53	59.03	W. Edge Gully: Sable Is. Bank	203
W-134 -025	15-Jul-94	2345	580.0	43.56	58.53	E. Edge Gully: Sable Is. Bank	246
W-134 -028	18-Jul-94	0900	765.3	44.06	62.25	LaHave Basin	152
W-134 -030	26-Jul-94	0200	1081.1	43.53	66.38	Eastern Bay of Fundy	117
W-134 -031	26-Jul-94	0830	1102.8	44.15	66.51	Central Bay of Fundy	176
W-134 -032	26-Jul-94	1657	1118.9	44.23	67.19	Western Bay of Fundy	111

Appendix 8. W-134 Surface Station Data

Station	Date	Time (hrs.)	Log (nm)	Latitude (deg. N)	Longitude (deg. W)	Surface Temp. (oC)	Salinity (o/oo)	P04 (uM)	Chl. a (ug/l)
SS-001	06-Jul-94	1500	3.9	41.18	70.52	21.5	31.587	0.087	0.631
SS-002	06-Jul-94	1720	13.9	41.09	70.43	20.5	31.731	0.314	0.622
SS-003	06-Jul-94	1915	23.9	41.03	70.32	21.4	31.764	0.000	0.594
SS-004	06-Jul-94	2137	34.0	40.56	70.19	20.0	32.253	0.322	0.552
SS-005	07-Jul-94	0120	41.7	40.45	70.83	19.1	32.219	0.150	0.583
SS-006	07-Jul-94	0400	56.0	40.39	70.01	19.7	32.203	0.030	0.562
SS-007	07-Jul-94	0700	67.8	40.31	69.53	19.9	32.267	0.000	0.406
SS-008	07-Jul-94	0930	77.9	40.31	69.38	21.9	33.207	0.000	0.309
SS-009	07-Jul-94	1130	88.0	40.31	69.22	22.3	33.182	0.217	-------
SS-010	07-Jul-94	2300	110.5	40.51	69.07	19.1	32.965	0.000	-------
SS-011	08-Jul-94	0040	113.4	40.55	69.04	16.7	32.766	0.000	-------
SS-012	08-Jul-94	0540	123.5	41.02	69.05	15.8	31.985	0.755	1.274
SS-013	08-Jul-94	1845	135.1	41.11	68.56	19.6	31.651	0.000	0.712
SS-014	08-Jul-94	2105	144.6	41.14	68.43	15.7	32.649	0.009	1.948
SS-015	08-Jul-94	2300	154.5	41.19	68.29	14.0	32.623	0.270	1.875
SS-016	09-Jul-94	0145	165.7	41.19	68.08	15.9	32.528	0.113	2.111
SS-017	09-Jul-94	0400	176.6	41.19	67.53	14.5	32.511	0.301	2.608
SS-018	09-Jul-94	0600	186.6	41.21	67.40	14.3	32.517	0.000	3.115
SS-019	09-Jul-94	0834	192.3	41.22	67.34	13.2	---------	---------	-------
SS-020	09-Jul-94	1835	202.0	41.16	67.25	14.8	32.490	0.171	1.707
SS-021	09-Jul-94	2200	212.8	41.18	67.16	13.0	32.718	0.536	3.338
SS-022	10-Jul-94	0200	222.2	41.18	67.03	16.1	32.376	---------	0.751
SS-023	10-Jul-94	1220	242.2	41.20	66.48	17.4	32.703	0.338	0.626
SS-024	10-Jul-94	1515	251.5	41.14	66.29	17.8	32.392	0.176	0.282
SS-025	10-Jul-94	1940	262.0	41.07	66.13	22.5	33.903	2.373	0.408
SS-026	10-Jul-94	2336	273.3	41.01	65.59	24.4	35.168	0.041	0.006
SS-027	11-Jul-94	0610	292.3	40.55	65.36	24.0	35.464	0.019	0.136
SS-028	11-Jul-94	1800	314.2	41.08	65.09	24.7	---------	0.000	0.145
SS-029	17-Jul-94	1216	678.8	44.04	60.36	16.8	31.516	1.001	-------
SS-030	17-Jul-94	1310	680.2	44.03	60.38	15.9	31.496	---------	-------
SS-031	17-Jul-94	1335	680.9	44.03	60.37	14.3	31.504	0.004	-------
SS-032	18-Jul-94	0002	721.0	44.07	61.29	18.2	31.066	0.000	-------
SS-033	25-Jul-94	2200	1057.2	43.23	66.14	11.4	---------	---------	-------